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United States Patent [19]

Sato

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[54] **METHODS FOR GROWING
SEMICONDUCTORS AND DEVICES
THEREOF FROM THE ALLOY
SEMICONDUCTOR GAINNAS**

[75] **Inventor:** Shunichi Sato, Miyagi-ken, Japan[73] **Assignee:** Ricoh Company, Ltd., Tokyo, Japan[21] **Appl. No.:** 08/834,959[22] **Filed:** Apr. 7, 1997[30] **Foreign Application Priority Data**

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[51] **Int. Cl.⁶** H01L 21/30[52] **U.S. Cl.** 438/478; 438/46[58] **Field of Search** 438/478, 45, 46,
438/47[56] **References Cited
PUBLICATIONS**

M. Kondow et al., "GaInNAs: a novel material for long-wavelength semiconductor lasers", IEEE Journal of Selected Topics in Quantum Electronics, vol. 3, No. 3, pp. 719-730, Jun. 1997.

Primary Examiner—Chandra Chaudhari*Assistant Examiner*—Keith Christianson*Attorney, Agent, or Firm*—Cooper & Dunham LLP[57] **ABSTRACT**

A method is disclosed for growing a nitrogen-containing III-V alloy semiconductor on a semiconductor substrate such as GaAs, which is formed by MOCVD method using nitrogen containing organic compounds having relatively low dissociation temperatures. The alloy semiconductor has a high nitrogen content which exceeds the contents previously achieved, and has a high photoluminescence intensity.

There are also disclosed fabrications of semiconductor devices comprising the alloy semiconductors, such as heterostructure and homo-junction light emitting devices.

21 Claims, 7 Drawing Sheets

